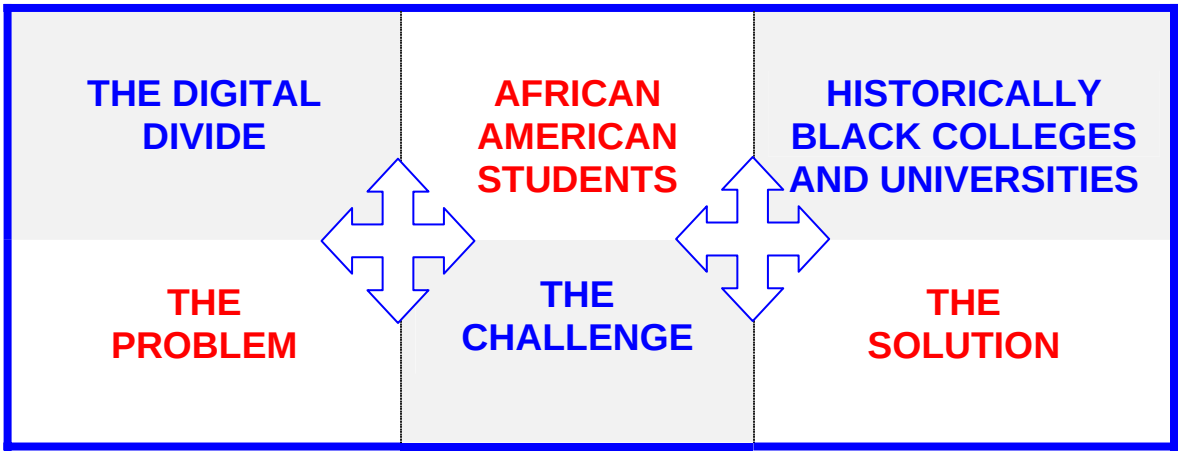
A Tractell Presentation Paper



September 22, 1999

An Invited Presentation at the:
MU-SPIN 9th ANNUAL USERS' CONFERENCE
At Florida International University
Miami, Florida

Sponsored by:
Minority University Space Interdisciplinary Network (MU-SPIN)
Goddard Space Flight Center
National Aeronautics and Space Administration

Presented by:
Eugene E. Jones, PhD
TRACTELL, Incorporated
4490 Needmore Road
Dayton, OH 45424, (937 233 9118)

TABLE OF CONTENTS

ABSTRACT

The “digital divide” denotes the well-documented disparity in the access to and use of computers, the Internet, and technology in general among ethnic groups in this country. It has been described is a socioeconomic dilemma of the technology age because of its disparate and negative impacts on minorities, especially African Americans and Hispanics.

Over 80% of the undergraduates are African American at Historically Black Colleges and Universities (HBCUs). Based on national demographics that define the “divide”, most of these students can be categorized as being “technologically underserved” before they enter college. A major challenge to HBCUs, therefore, is to assure technology parity before these students graduate to the workforces of the future. To meet that challenge, substantive technology resources and supporting infrastructures at HBCUs must exist.

In that regard, there is an alleged “digital divide” between HBCUs and other higher education institutions (HEIs) in this country that may be further aggravated by the demographic profile of their students. The evidence to either support or deny this allegation is sparse but persistent, yet no formal assessment is known.

This paper-presentation seeks to place these issues in the proper “solution” perspective that is needed to meet the challenges of assuring places for HBCU students in the workplaces of the New Millennium that, for sure, will be characterized by high technology. In that environment, “*technology will ask no questions, take no prisoners, and be an equal-opportunity annihilator for those not actively engaged therein*”. In short, there are no other options available.

THE DIGITAL DIVIDE, AFRICAN-AMERICANS, AND HISTORICALLY BLACK COLLEGES AND UNIVERSITIES (HBCUs)
The Problem, The Challenge, and the Solution, Respectively

THE PROBLEM: THE "DIGITAL DIVIDE"

The "digital divide" denotes the well-documented disparity in the access to and use of computers, the Internet, and technology in general among ethnic groups in this country, specifically among Blacks and Hispanics as compared to other groups. This "divide" is defined in terms of ethnic groups, household income and composition, age, gender, and location. This "ethnic divide", which is steadily and rapidly widening over time, has been described as a socioeconomic dilemma interwoven inextricably within the fabric of this nation.

In effect, it is apparent that technology asks no questions, takes no prisoners, and is an equal-opportunity annihilator for those not actively engaged therein. As a result, there is an alleged "digital divide" between Historically Black Colleges and Universities (HBCUs) and other academic institutions in this country. These alleged differences can be isolated to the following areas that are neither all-inclusive nor mutually exclusive:

- **Technology Resources** (hardware, software, communications, etc.)
- **Technology Planning** (budgeting, funding support, priorities, etc)
- **Technology Applications** (administration, teaching, research, support)
- **Technology Infrastructure** (the "glue" that binds the above to education)

That is, while other US academia have strongly embraced and rapidly incorporated the fast evolving digital technologies, there are equally strong indications that many if not most HBCUs lag *significantly* in this arena despite the differential needs warranted by existing student demographics. Still, the evidence to support this allegation is anecdotal yet persistent as follows:

- **Technology Resources and Applications**: A March 1999 article in T*he Chronicle of Higher Education, entitled "HBCUs Band Together for Technology"* reflected sparse or non-existent Internet technology within a collaborative group of both public and private HBCUs spanning several states. Several of this group lacked basic Email service and some did not have complete campus local area networks (LANs) as of 1999. This article indicated proposals to private foundations to help ameliorate those needs.

- **Technology Resources**: Long-standing federal programs such as Title III (developing institutions) in the Department of Education, NASA Network Resources and Training Sites (NRTS), DoD HBCU/MI Infrastructure Program, and others have been targeted to technology enhancement at HBCUs and other minority institutions. Private foundations such as Kellogg and Kresge have addressed the shortfalls of technology in minority institutions. Several

educational organizations, such as EDUCAUSE, NASALGC, and others have focused national attention onto the technology "haves and have-nots" in academia and the deleterious effects. Major computer vendors, IBM, Dell, Compaq, etc., have long-standing programs involving technology alliances with minority institutions to include several HBCUs.

- **Technology Resources**: As a rule, equipment budgets parallel total research expenditures, which, in turn, tend to be good metrics for technology integration at the institutional level although there are notable exceptions. In that connection, almost 100% of the funding for research-related equipment at HBCUs through 1997 was derived from federal sources (grants, contracts, etc), as compared to less than 75% for all academia.

- **Technology Resources, Applications, and Planning:** As of 1999, only one of the 104 HBCUs is a member of Internet2 or other second generation networks including Abilene and vBNS compared to 1 out of 18 US academic institutions in general (i.e., about 200 of 3800 institutions). Inevitably, this is the technology that will usher distance learning to its full potential (as well as other benefits). This event, in turn, will revolutionize completely the educational delivery systems as we know it today.

- **Applications and (Academia) Planning:** In July 1999, testimony on the "Digital Divide" before the House Business Empowerment Subcommittee elicited the statement "…*unfortunately, HBCUs just have not bought into this technology*". This statement was a response to a question about whether HBCUs were adequately preparing African-American students to enter the high technology information and telecommunications workforce where high-paying jobs are plentiful and now go begging for applicants. (As a side note, for all academia since 1992, a greater percentage of African Americans enter computer science as a major than Whites).

- **Applications and Infrastructure**: In April 1999, an HBCU support organization comprised of private sector executives, reported that fewer than 12% of the students at these institutions routinely used Email compared to 94% at non-HBCUs. This article, which appeared nationwide in Cox Newspapers under the byline "*Black Colleges Lag in High Tech*", also indicated a lower percentage of revenue to support technology at HBCUs than at other institutions.

THE CHALLENGE: HBCU STUDENTS' NEEDS FOR THE WORKFORCE

The July 1999 Department of Commerce study defines the "digital divide" in terms of four ethnic groups (White Non-Hispanic, Black Non-Hispanic, Hispanic, and Other Non-Hispanic), household income and composition, education, age, gender, and location (region, inner city, urban, rural). Considering these criteria, the alleged "digital divide" at HBCUs is likely to be accented, compounded, or sustained by student demographics. Specifically:

- **Ethnicity:** Eighty two (82%) of the 280,000 undergraduate students at HBCUs are African American (NSF Caspar data for 1996)

- **Age:** Most HBCU undergraduates are younger than their counterparts in other academia, as is the African American population in general below age 35 (Bureau of Census data, 1998)

- **Gender**: Over sixty (60%) percent of undergraduates at HBCUs are female compared to 52% nationally in 1996 (NSF Caspar data, 1998)

- **Income:** Over 77% of HBCU students are eligible for, or receive, federal student aid (i.e. Pell) as compared to 37% of their peers in other academia. This metric is an indicator of lower parental income levels (Pell award data in NSF Caspar database, 1998)

- **Household Composition:** More than 60% of HBCU students come from households headed by a single female as compared to 30% otherwise. These households are least likely to own computers. (Bureau of Census, 1998, 1999, Annual Surveys)

- **Location:** About 63% or nearly two-thirds of African American undergraduates come from high schools in inner cities, where most have limited technology relative to suburban schools. This statistics compares to 27% for Whites undergraduates. (Department of Education, State of Education, 1998)

Arguably, this student demographic profile uniquely characterizes a technologically underserved group as they enter college. Thus for most undergraduates, HBCUs become the first, the last, and the only source of technology before entering the workplace. This is the critical challenge of the current technology revolution in the educational arena that must be resolved.

But what do HBCU students need in terms of technology and why? The answer to this question is (should be) self-evident. HBCU students need exactly the same technology tools as students at Georgia Institute of Technology, at Florida State, Florida International University, or Carnegie Mellon. But why is this true?

The most inclusive answer to the latter question is that “technology asks no questions, takes no prisoners, and is an equal-opportunity annihilator for those not engaged therein”. That is, the virtual world of the Internet does not make exceptions for where a student is located. For example, limited “technical” libraries were the bane of every HBCU as a major impediment to academics and research in the 1980’s and well into the 1990s. This “impediment” no longer exists with access to the Internet and the skills and tools for its use. Now, an HBCU student -- anywhere -- has exactly the same opportunity to surf the Library of Congress for input to a term paper as one from Harvard … if the resources are available lo-

cally. But without these resources, the old impediments remain active with the disadvantages to the student that simply multiply exponentially over time.

For the HBCU student-graduate, the actual workplace of the future will be equally unforgiving. This workplace will not make exceptions as to why one is not already technologically proficient on arrival since on-the-job "remediation" is not an option (This critically important message was brought to the forefront recently by an HBCU support organization consisting primarily of corporate executives.) In short, for most undergraduates, HBCUs are the first, the last and the only source of technology before entering the workplace.

FACTORS BEARING ON THE SOLUTION

Are Technology Catch-Up Strategies at HBCUs Working at Present?

The best answer is that one does not know whether such strategies are working or not, mainly because technology is changing so fast, and no formal assessment of this issue is known. It is known that several programmatic efforts are working toward this catch-up goal. For example, support programs on HBCU campuses include Title III and NASA NRTS. More recent programs include the VITAE project (Virginia Tech), Technology Assistance Program (TAP, Executive Leadership Foundation) and possibly many others too numerous to mention here. For these and similar programs, the following questions are relevant:

- Do these external support activities serve as catalytic generators for more expansive technology enhancement at the internal level at affected institutions? Are HBCU management-level checks and balances in place to assure these leverages?

- How pervasive are these program impacts within the affected institutions' technology infrastructures? Do the latter serve as metrics for continued programmatic funding from external sources?

- What is the level of institutional dependency on these programs subsides, and are their contingencies?

- Are both external and internal programmatic assessments made to answer such questions?

As of 1999, there is universal uncertainty as to how (of if) the above-cited issues and facts are being addressed formally within individual HBCUs or collectively. How would YOU answer the following questions for YOUR institution?

- Is YOUR institution keeping pace in telecommunications and information technology services with other comparable academia (i.e., 4-yr or two year, public or private, small or large, rural or urban, etc)? (Yes) - (Maybe) - (No) - (Do Not Know)

- Has YOUR institution's management acknowledged the potential compounding effects of the alleged "digital divide" on its student population, most of whom very likely were technological underserved before coming to college? (Yes) - (Maybe) - (No) - (Do Not Know)

- Is there definitive evidence that these issues are being attended at YOUR institution, such as formal technology assessments and plans, infrastructure asset enhancements, support staffing, organization for change, etc.? (Yes) - (Maybe) - (No) - (Do Not Know)

"Dancing With the Devil" –Pursuit of Technology on the Cheap

Research budgets are often a good barometer to technology resources and application in academia. Nearly 100% of the research-related equipment at HBCUs tended to come from federal funding through grants and contracts. A lot of HBCU funding for academic equipment (computers, networks, etc) is also derived through Title III. Levying technology-specific fees for students is a recent trend that has taken hold. In combination, these events have created a dilemma in all academia requiring ever-increases in tuition to cope with fast moving and ever changing technology.

As another solution, many (major) institutions have opted for exclusive contracts with technology vendors in which mutual benefits accrue due either to volume purchases, customer loyalty over time, or both. These creative arrangements between business and academia have been labeled as "dancing with the devil' due to the possible negative outcomes in the long term, such as cross-contamination of academic curricula to suit a responsive vendor.

Where Are There Bottlenecks in This Solution Path?

Is it at the HBCU Management Levels? It can be safely contended that no academic institution has become technological adept without a plan. No technology plan has been effective without implementation, and no implementation has been effective without associated costs. No cost has been expended without a priority among options. No options have been logically established without decision-making within a well-defined span of control. In short, it is impossible to "get-there-from-here" without the attention of management and formalized planning.

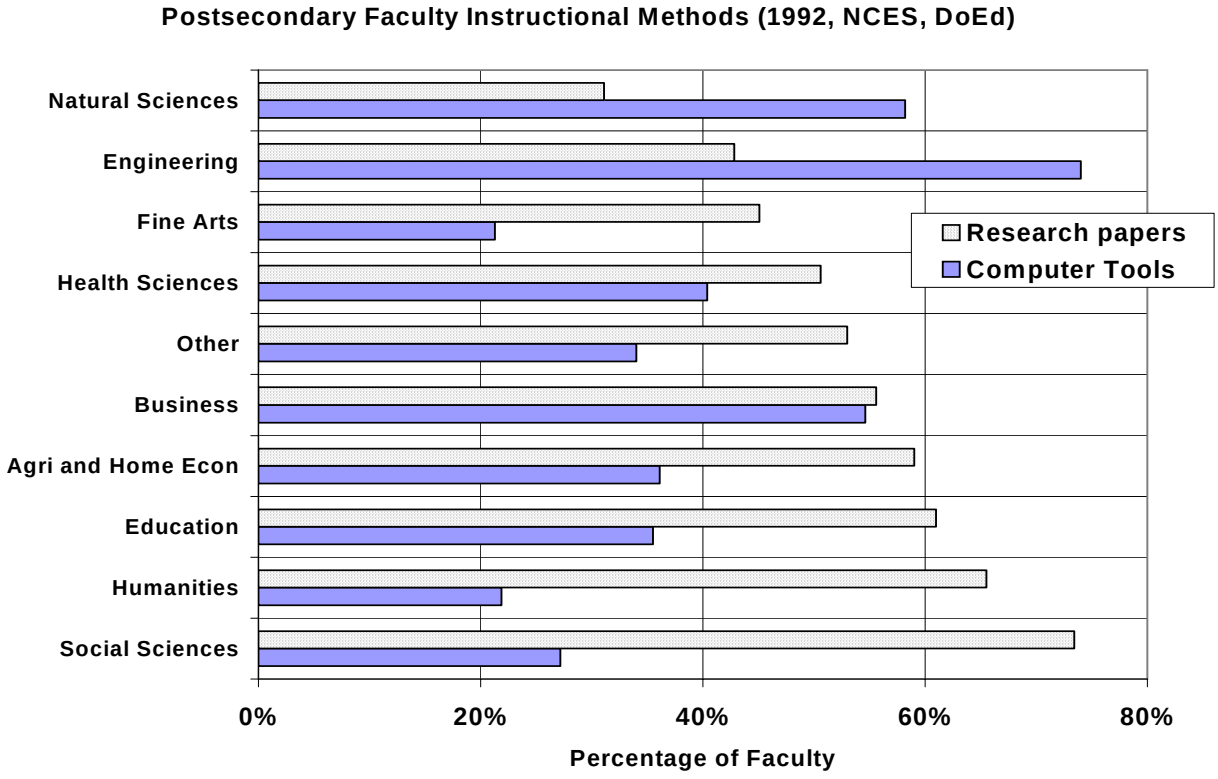
But in theory, "management" is responsible for everything. In particular, those problems and issues affecting the fabric of the institution horizontally and vertically, socially, economically, and financially, are relegated to management for resolution. The presence or absence of technology within an institution fits those criteria. Yet, the inevitable response to systemic technology enhancement at HBCUs has been a "shortage of funds" , "underfunding", or "lack or priority", or the equivalent. Yet it costs about thirteen cents ($.13) to send a one-page Email to 1000 faculty or staff (or to 10,000 or 100,000) versus a minimum of about $600

to send a one-page typed letter. Undeniably, other tradeoffs in favor of even limited technology applications are positive, equally large, and expand over time.

At the Faculty and Staff Support Levels? A recent national news item (*USA Today*) shows professors having insufficient time to keep abreast of the fast changes in technology, or most importantly, to keep abreast of the aptitudes of their students. As a result, many simply opt out in regard to requiring the use of the Internet or even Email in their classes. Many are favoring "unlisted" Email addresses due to the volume of traffic that must be perused each day.

The latest Department of Education statistics on the use of computerization in the post-secondary classroom are dated in 1992, which is pre-Internet. Those statistics (Exhibit 1) showed about 40% of faculty used computers in classrooms with higher exceptions in engineering, natural sciences and business. Yet, computer usage tended to decrease as term or research papers increased. More recent post-Internet data may be radically different from, or maybe not.

Exhibit 1: Computer Usage in Postsecondary Classrooms



As related to faculty, the trend to virtual or Web-based or media-assisted education (distance learning) is quite formidable as of 1999. Clearly this trend will revolutionize education as it is known today. Two recent writings in academia (NASULGC executives) and industry (SUN Microsystems) focused in on imminence of distance learning as THE next generation of academia, which will blend traditional learning and lifelong learning with the workplace and into the home. In that context, those institutions with experiences in the new broadband technology such as Internet2, vBNS, Abilene, and other broadband networks, will again lead the fleet in distance learning, and "digital divide II" will be commence.

Among the HBCU Students? According to a national survey (*USA Today*), students are willing to pay "technology fees" for desired services rendered, and many schools now charge as much as $115 per academic term which must be fully dedicated to technology enhancement. But this "solution" aggravates another problem in that such fees are actually increases in tuition, which is already increasing at an alarming rate on a national scale. Nevertheless, with this delineation of cost to a specific line-item service (i.e., technology), it is highly likely that the demands by students will increase to match.

Lessons Learned From the Past (How did this alleged divide begin?)
Computerization at HBCUs, as with most academia, evolved for administrative purposes, then for research, and then for academic support and was often maintained as separate services to include personnel and facilities. As computerization matured in the early-1980s, most academia acquired mainframes through ownership and treated them as capital assets with depreciation.

Minicomputers replaced mainframes in the mid-1980s; new purchases were needed among academia, and new funding was required. To gain larger shares in this new and changing market, large vendors made big concessions to institutions on the conditions of loyalty and maintenance agreements whose costs were *inconceivably* steep. But since significant funds for new computerization were being funneled through Title III, major computer vendors actively courted the Title III institutions through lists obtained directly from the Department of Education.

The minicomputer with "dumb" terminals and dialup services constituted the campus network in the early to mid 1980's. In the late 1980s to the early 1990s, these structures were replaced by stand-alone microcomputers (PCs) with dialup services, and on many campuses, they were linked to coaxial LANs. This configuration prevailed as a baseline link to the Internet, which was to arrive later in the early 1990s.

However because of "sunk costs", many small schools simply retained the technology even as maintenance costs soured and the Internet became more pervasive elsewhere. As late as 1996, many HBCUs maintained 1980 vintage DECs and IBMs to support administrative computing at the same time that standalone PCs began to support the educational and research areas.

It was this disjunctive period that signaled the beginning of a "digital divide" in terms of computational resources at many small institutions, but particularly at many HBCUs.

The introduction of the Internet after 1994 simply compounded an already existing problem at HBCUs because older campus systems were incompatible with the new Internet protocols and throughput requirements. Fiberoptic cabling rather than the old co-axial cable was needed to support campus LANs linked to the Internet. Older equipment simply did not work or worked poorly or unreliably. Upgrades required serious outlays of funding on many campuses, which simply was either not available or not prioritized accordingly. As a direct result, many HBCUs began LAN upgrades in the mid-1990s well after other academia.

In short, the slower the technology resource changeover during these periods of transition, the faster the "resource" divide grew between HBCUs and other academia. This consequence is evident on many HBCU campuses at present (1999), a fact that adds further evidence of the "alleged digital divide".

RECOMMENDATIONS FOR A SOLUTION

The solution to the alleged "divide" subsumes HBCU management, faculty, support staff, and students, but in unequal proportions and responsibilities. If incoming HBCU students, lacking prior exposure, do not demand technology services in support of their academics, there is little likelihood that faculty can make assessments of need and register those needs to higher management for funding. On the other hand, if HBCU management does not pre-assess the technology needs of its students for the future workforce, there will be little change in funding priorities for technology.

So, it is best to present a solution-path in holistic terms as viewed by both top management and operational levels. This perspective begins in Exhibit 2 with the strategic plan of the institution, technology vision, goals, plans and tasks in a systems-management approach. There is nothing new about this solution approach, except that concepts related to Change Management Intervention (CMI) must be forcefully injected into this process to eventuate those changes needed.

Exhibit 3 looks at the operations and implementation side of the solution in terms of an input-output paradigm. Current resources are matched with future needs based on student-driven requirements for the future workforce. These needs must be assessed by faculty and other resource personnel on a continuing basis. This process is iterative and cyclical over time through management, faculty, and support staff in such a way that pre-stated goals and strategies (Exhibit 1) are attained in a timely, orderly, and cost-effective manner. In short, the entire process is continual and becomes a systemic institutional function.

Exhibit 2: CAMPUS TECHNOLOGY SOLUTION SPACE AS VIEWED FROM TOP LEVEL MANAGEMENT

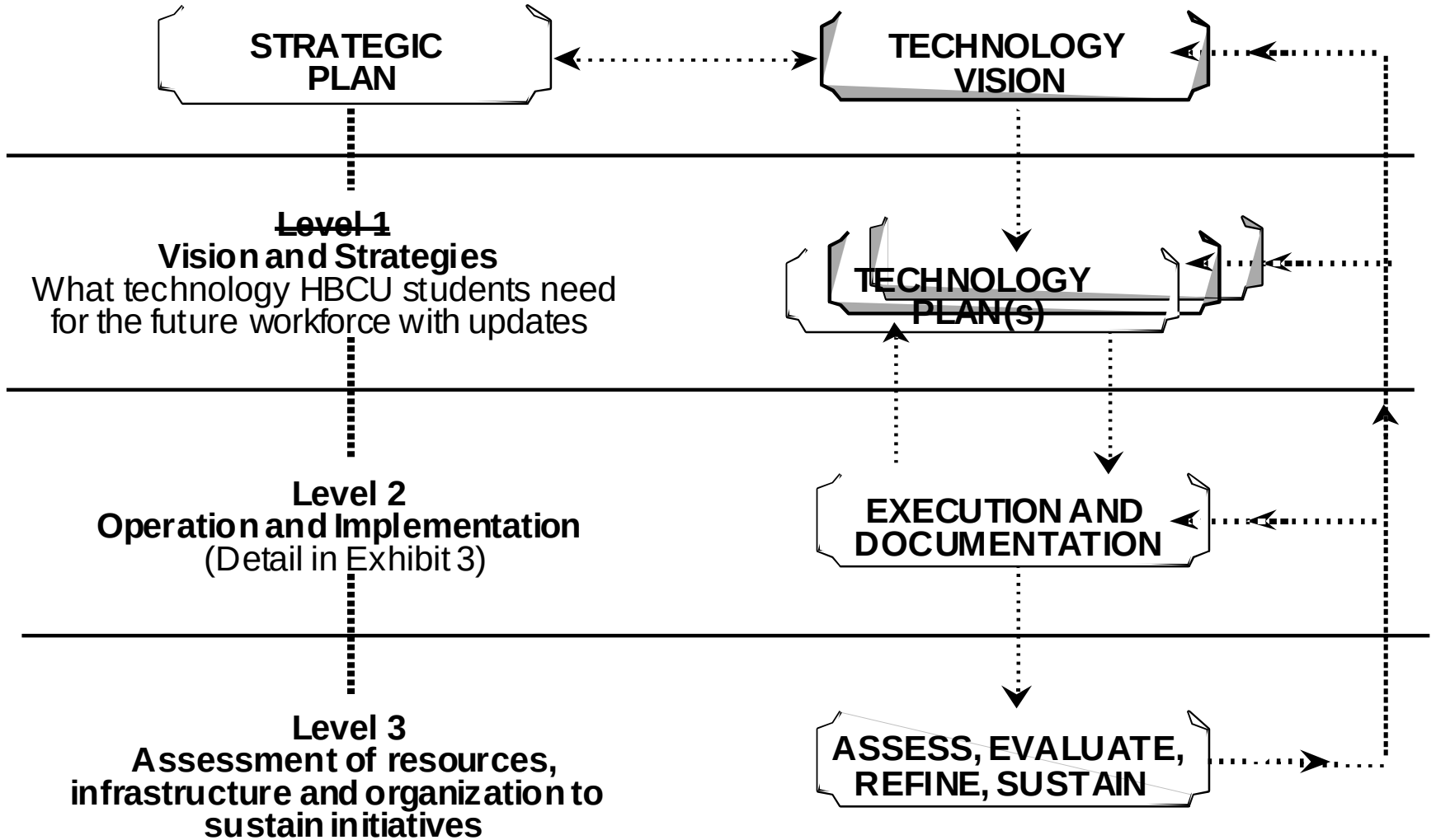
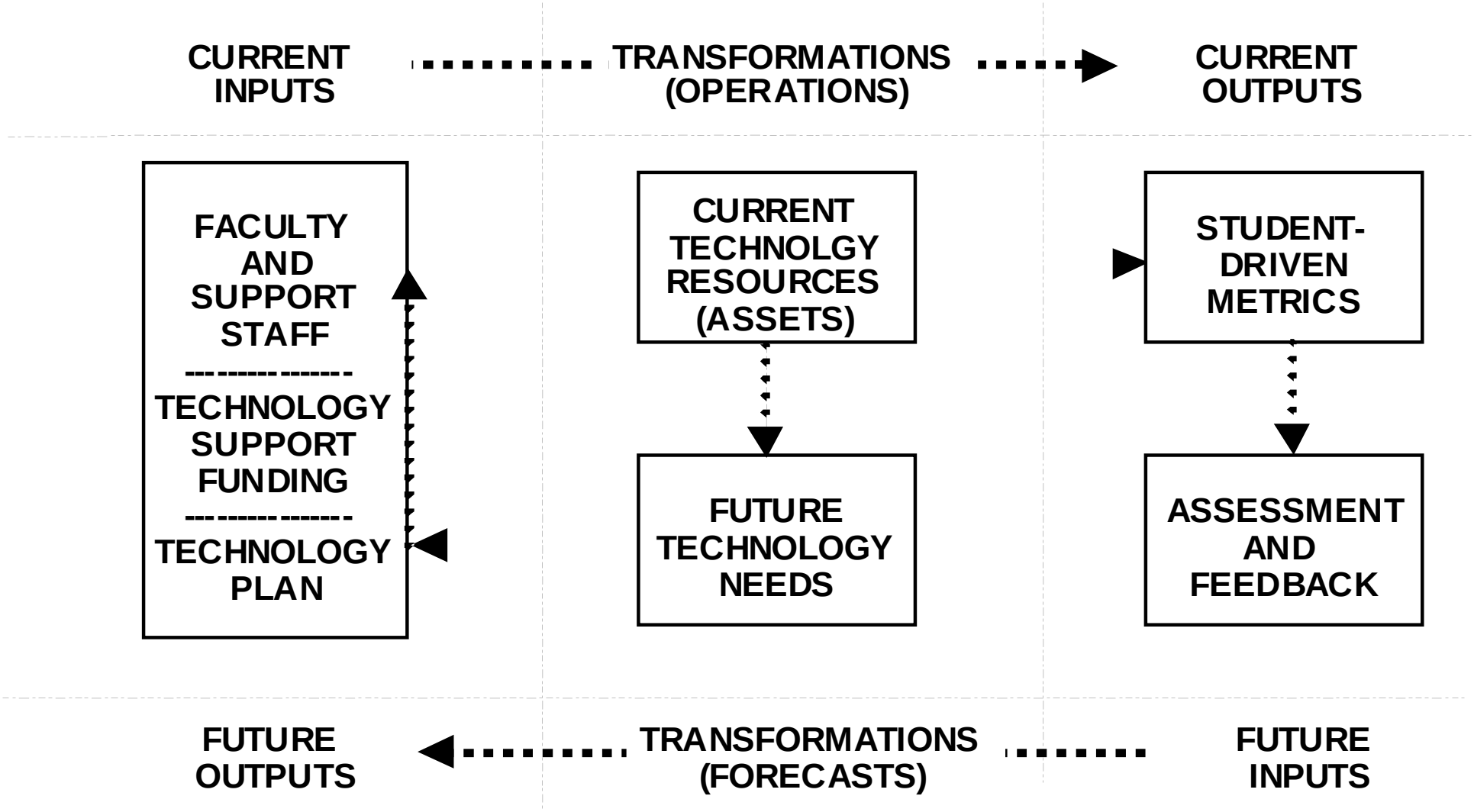


Exhibit 3: CAMPUS TECHNOLOGY SOLUTION SPACE AS VIEWED FROM THE OPERATIONAL LEVEL



ABOUT THE AUTHOR ….

Dr. Eugene E. Jones, is the founder and President of TRACTELL, Incorporated, a small business specializing in research, engineering and consulting, in Dayton OH. He received his bachelor's degree in mathematics with emphasis in physics from Tennessee State University. He received a master's degree in mathematics with emphasis in computer science from Pennsylvania State University, and a doctorate in systems engineering from Ohio State University in 1978.

Dr. Jones, a retired Lieutenant Colonel from the Air Force, served as mathematician, computer systems analyst and designer at the Air Force Logistics Command at Wright Patterson, concentrating in research on large databases for logistics. He was Research Director in the Avionics Directorate at Wright Patterson, AFB, OH where he and several others helped to initiate the first known "set-aside" for HBCUs in 1978 for $1,000,000, an event that is one of the forerunners of the current DoD-wide HBCU program valued at nearly $40M per year.

In the Air Force, Lt. Col. Jones completed a distinguished flying career with over 5000 hours in heavy bombers and fighter reconnaissance aircraft. He completed 155 combat missions in which he earned the Silver Star, the Distinguished Flying Cross, and fifteen (15) Airmen's Medals, among others.

During his military career, Dr. Jones served as associate professor in systems management at the Air Force Institute of Technology (AFIT) at Wright Patterson. After retirement, he served a tenured professor in the Management Science Department in the College of Engineering at the University of Dayton. He has 14 years of teaching experience at the graduate level in mathematics, statistics, numerical analysis, and differential equations. He specialized in computer-based applications in operations research and management science, decision making under cost constraints, cost estimation, quality control, and reliability theory.

In his professional career, Dr. Jones has served as the principal investigator for twenty two (22) contracts, grants, and subcontracts with the Department of Defense, NASA, NSF, the Federal Aviation Administration, and private industry. TRACTELL is the winner of five (5) Small Business Innovation Research (SBIR) awards dealing with innovative applications of embedded memory modules to enhance equipment maintenance. Dr. Jones has also been engaged in expert testimony and consulting in utility regulation with the State of Ohio and Virginia. He was principal investigator for three state projects to increase the participation of minority businesses in high technology in Ohio.

He has conducted Total Quality Management (TQM) workshops at Central State University, Wilberforce University, Southern University at New Orleans, and Tennessee State University. Dr. Jones was the principal for two DoD efforts dealing with technical assistance for HBCUs and MIs during the period from 1985 to 1995. The purpose of each contract was to increase the participation of HBCUs

in DoD's R&D procurement. During that time, TRACTELL interacted with 72 of the 104 HBCUs, and ten (10) other minority institutions in terms of on-campus technical seminars on R&D procurement with DoD. In the 1994-1995 period, the time of the TRACTELL contract, DoD R&D obligations to HBCUs rose nearly 45% to its highest level ever.

In 1997-1998, Dr. Jones served as manager for the TRACTELL subcontract at the DoD Major Shared Resource Center (MSRC) located at Stennis Space Center, MS. This engagement, which resulted from an unsolicited proposal to a major DoD prime contractor in November of 1995, encompasses the technical and administrative coordination of five (5) HBCUs in the DoD High Performance Computing Modernization Program (HPCMP). The total award to these institutions was estimated at $4,800,000 over five years. Relevant HBCU-related documents by Dr. Jones include the following:

> The "GuideBook for Research Acquisition and Management for HBCUs in the DoD Environment", and "The TRACTELL Grant and Contract Tracking System" (GCTS),1992. Over 2000 copies and one copy of the GCTS software to 65 HBCUs. Co-author with Dr. Earnestine Psalmonds, currently serving as Vice Chancellor for Research, NCA&TSU
>
> "The 1995 Directory of Research Capability Data on HBCUs and Minority Institutions". DoD contract deliverable compiled faculty and institutional profiles from 75 HBCUs and MIs.
>
> "A Quantitative Assessment of the 'Financial Health' of Historically Black Colleges and Universities From 1966 to 1995". This document uses "net revenue" -- the difference between revenue and expenditures -- as a measure of "financial health" to rank all HBCUs over three decade period.
>
> "An Analysis of the Sponsored Research Environment at Southern University Baton Rouge", an arms length critical review of the sponsored research environment, with recommendations.
>
> "Why and How Fast is the "Digital Divide" Widening Over Time Among Ethnic Groups in this Country? An exploratory, analytical perspective", TRACTELL technical paper, September 1999.

*****

D:\word97\Winword\WORK\DigitalDivide\MUSPIN Presentation 92299.doc
Friday, September 17, 1999, 1:43:28 PM